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THE TEACHING OF GEOGRAPHY—A CRITICISM AND A SUGGESTION[1]

By ROLLIN D. SALISBURY
University of Chicago

INSTRUCTORS of college students often have occasion to notice the lack of geographic knowledge on the part of their pupils. This lack is so conspicuous that the instructor is often embarrassed by the necessity of explaining the most elementary facts—facts which every boy and girl knew, so it seems to him, in the good old days before the teaching of geography was reformed. I venture to point out one or two of the current deficiencies which have impressed me most.

In the first place, there is a conspicuous lack of knowledge of the location of places. The most striking illustration of this which has ever fallen under the writer's observation was afforded by a woman about to graduate from college after pursuing a literary course, who was unable to point out the state in which she lived, on a large wall map of the United States.

Another conspicuous defect is lack of knowledge of what things are. Thus Albuquerque may be a country, Manitoba a city, the Volga a kingdom, and the Selkirks a tribe of Indians. If the students who come through the schools to college are without adequate knowledge of the location of places, and without a knowledge of what geographic names stand for, it is probably even more conspicuously true of those who do not go to college.

The current and common deficiencies along these lines are illustrated by the answers to the questions or group of questions stated below. The test was given to about seventy-five students, most of them in the early years of their college courses. The exercise consisted of 11 composite items, as follows:

I. With a wall map of the United States before the students, ten

[1]Reprinted by permission from *Educational Bi-Monthly*, June, 1909.

states were pointed to, and the students were asked to write their names. No time was given beyond that necessary for the writing of the name of one state before the next was pointed to. The states were:

1. South Carolina.
2. Arkansas.
3. Wyoming.
4. Utah.
5. Oklahoma.
6. Oregon.
7. Virginia.
8. Vermont.
9. Minnesota.
10. Missouri.

The average number of states correctly named was 5; but there were 4 students who did not name a single state correctly, and 19 students named less than 5 correctly.

II. The second question had to do with cities. The cities were pointed out on the wall map as the states had been. The cities were:

1. Buffalo.
2. Albany.
3. Cincinnati.
4. Birmingham.
5. Memphis.
6. Kansas City.
7. Omaha.
8. Spokane.
9. Pittsburg.
10. New Orleans.

The average number of correct answers was 4.3, and 38 students had less than 5 correct.

III. The third question, presented in the same way, had to do with rivers. The rivers were:

1. The Columbia.
2. The Potomac.
3. The Missouri.
4. The Tennessee.
5. The Arkansas.
6. The Colorado.
7. The Wabash.
8. The Connecticut.
9. The Platte.
10. The Yukon.

The average number of correct answers was 5.6, and 25 students had less than 5 correct.

IV. The fourth question had to do with bays, gulfs, and sounds. The list was as follows:

1. Mexico.
2. Hudson.
3. Chesapeake.
4. Puget.
5. San Francisco.
6. Delaware.
7. California.
8. Fundy.
9. Long Island.
10. Mobile.

The average number of correct answers was 5.8; 14 had less than 5 correct.

V. The fifth group involved the location of mountains. The names of the following ranges were given, and the students asked to locate them by states:

1. Sawatch.
2. Uinta.
3. Cascade.
4. Teton.
5. Sierra.
6. Ouachita.
7. Bitter Root.
8. Catskill.
9. Olympia.
10. Klamath.

The average answer had 2.5 correct; 65 had less than 5 correct. The Catskills were the only mountains located correctly by nearly all, and none of the others except the Sierras was correctly placed by many.

VI. The sixth group was like the fifth, except that lakes were involved. The lakes were:

1. Chelan.
2. Crater.
3. Tahoe.
4. George.
5. Great Salt.
6. Great Bear.
7. Minnetonka.
8. Skaneateles.
9. Chautauqua.
10. Erie.

The average answer located 4 of the 10 correctly; 45 students had less than 5 correctly placed. Great Salt Lake and Lake Erie were the only ones correctly located by most.

VII. The seventh question involved the naming of the largest city in each of the following states:

1. Washington.
2. Michigan.
3. Wisconsin.
4. Nebraska.
5. Texas.
6. Indiana.
7. Maryland.
8. Utah.
9. Canada.
10. Massachusetts.

The average answer had 7 of the 10 correct, but 9 fell below 5. Michigan, Nebraska, and Canada fared the worst. In the case of Texas, where no city had a conspicuous lead, the answers were not marked incorrect if one of the leading cities was mentioned.

VIII. The eighth question involved five parts:

1. Name the railways which run from the central Mississippi basin to the Pacific coast.
2. Name the most important canal now being dug.
3. Name 3 great railway systems of the central Mississippi basin.

4. Name the canal in the United States which has played the largest part in the commercial history of the country.
5. Name the national parks.

The average response to these questions was about half correct. 1 and 5 were answered badly, 2 and 4 fairly well, and 3 indifferently. One student gave no correct answer.

IX. The ninth group was:

Name: 1. The largest state in the Union.
2. The smallest state.
3. The most populous state.
4. The least populous state.
5. Locate the center of population in the United States.

The average answer to this group of questions was about two-thirds correct. The first two were answered much better than the last three.

X. The tenth question was: What and where are the following:

1. Little Rock.
2. Albuquerque.
3. Manitoba.
4. Manchuria.
5. Volga.
6. Siam.
7. Brussels.
8. Butte (proper name).
9. Selkirks.
10. San Juan.

The average answer to this question had 5.4 of the 10 correct.

XI. The eleventh question included three items:

What are 1. Forest reserves.
2. Irrigation projects.
3. Dry farming.

The average answer to this question was perhaps half right, though many of the answers were vague. Two students gave no intelligible answer.

From the papers, the following somewhat remarkable facts were gleaned:

The largest city of Nebraska, *Kansas.*

The largest city of Indiana, *Indian City.*

The largest city of Wisconsin, *Superior.*

The smallest state, *Rock Island.*

The least populous state, *Ariszonia.*

Albuquerque "is a country in New York."

Manitoba is "the capital of British Columbia;" also "a city in New York."

Lake Erie is "west of Pennsylvania and north of Iowa;" also "on top of Ohio."

In the list of national parks, "Battery Park" was found.

Long Island sound was identified as Cape Cod.

The center of population was placed in New England by two students; in Washington by another, and "around the Mississippi basin" by another.

Forest reserves are "regions owned by the government in which a natural thing is protected;" also "a tract of land reserved by the government against being cut down," "a part of the country for hunting game," and "a problem what has been up for the sake of keeping forests."

Irrigation projects are "sheep 'fans,' or dry land moist all the year through;" also "drainage of dry land by artificial means," and a "question of how to obtain good drainage."

About two-thirds of the students writing the above tests had studied geography in the public schools, and one-third in private schools. Most of them had not studied the subject since they were in the grades, the latest study having been, as a rule, in the sixth or seventh grade. The answers illustrate forcibly the condition of the average student's mind with reference to what things are and where they are, in the world of geography, on entrance to college.

The old-fashioned teaching of geography involved such things as the bounding of states and countries, the names and locations of the capitals and large cities of each, the principal products and manufactures, the principal rivers, etc. It is evident that this phase of geography has been abandoned to a large extent. So has the "how-to-get-there" phase, illustrated by such questions as: How would you go from Chicago to San Francisco? From New York to Japan? The abandonment of these and similar phases of the subject is responsible for many of the deficiencies illustrated by the answers to the questions cited above.

The bounding of states, the locating of cities and rivers, the memorizing of principal products and manufactures, etc., was not the best sort of geography; but it was definite and tangible, and it put the pupil into possession of facts which were useful.

What has taken the place of the old-fashioned sort of geography? What substitute have we for the bare, dry, uninterpreted facts which pupils used to learn? It must be confessed that it is a little difficult, from the product of the schools, to discover what has been substituted. Perhaps there is a greater tendency than formerly to connect physical geography

and the life of the people. This would be a great gain if the tendency were pronounced, and especially if it were broadened and deepened so as to make the relations between physical geography and life in general clear, but it has not gone so far. It is not true that the teaching of geography has degenerated into "chatter about sociology in the country," nor that it is merely "a form of entertainment based on facts and pictures of life in the country;" but there is enough of truth in these characterizations to give them some point, and to suggest the need and the direction of improvement.

Home geography, in name at least, has been much emphasized, and home geography is excellent in the hands of teachers who know it and who know how to teach it. But it is of as little value as anything which can be made to occupy the time of pupils in the hands of others. And how many teachers have had opportunity to know their home geography well enough to teach it effectively? Home geography is a phase of nature study and of field work. Under the guidance of a master there is no better work; but the teacher who knows no phase of nature well, can not direct nature study effectively. To force work under this name upon teachers who do not know how to do it, is doing them and their pupils injustice.

No one is set to teach Greek, Latin, German, or French who has not studied these subjects. The same is true of mathematics, and to a less extent of physics and chemistry. Though the text-books in these latter subjects are in English, they have a semi-technical language of their own which is not mastered at the first reading. But too often it is assumed that anybody can teach geography because its language is not technical.

Much useful geography knowledge can be gained by the faithful study of books about geography. The painstaking teacher, even without special knowledge of the subject, can secure the acquisition of the facts recorded in a book about geography. This would not be ideal teaching—by itself it would not even be good teaching; but it would be something. It would perhaps be better (or less bad) than the corresponding sort of work in mathematics or chemistry.

But it is not the fashion now to teach geography from books—at least it does not seem to be the leading fashion. Even in some of the schools which prepare teachers, the prospective teacher is taught that she must not be hampered by a text-book on geography. This is an admirable doctrine when properly carried out. But is not doing away with a text-book as bad as being a slave to it? If the pupil is not to have a text-book it means,

too often, that the teacher culls a few facts from the rejected text—as many as she has time to gather and as her pupils have time to write down in their note-books. The facts they acquire in this way are fewer than they might possess themselves of with the same amount of time and effort if they had a good text-book, and they are probably far less accurate. It is the inaccurate reporting of facts by the teacher, or the more inaccurate hearing and recording of them by the pupil in his note-book—often a mine of misinformation—which is responsible for such statements as that which makes Albuquerque a country in New York, and Arizona the capital of Little Rock. Why indeed should a pupil not have a text-book at hand, in which he may see the names and locations of places? The average pupil who had used a book would hardly write Yucatan for Yukon, or name the sound in Washington, Pugget, Pudget, or Pudgen, as some of the writers cited above did. The attitude of superiority to text-books is hardly less bad than slavery to text-books.

The time spent in making plans for work in geography, in many places at least, has long seemed to me to be disproportionately large, as compared with the time spent in acquiring the information which it is planned to teach. The chances are that the plan made by the average teacher for teaching geography is not so good as the plan of any one of the better text-books, and when it is carried out without text-books, or with no more than incidental use of them, the result must always be unsatisfactory. I believe that the teacher who has not made a special study of geography will do better to follow a text-book than to strike out on plans of her own through a field with which she is not intimately familiar.

I would not be understood to imply that mere text-book teaching is satisfactory. Memorizing a text-book for class-room recitation is far from ideal work; but other and newer fashioned methods of work may be still less satisfactory, and accomplish even smaller results—and results are the great test.

In conclusion, I beg leave to state two questions for the consideration of teachers of geography:

1. Would not a larger use of text-books and maps give better results?

2. Would it not be better to give relatively more time to enriching, illuminating, and adapting the substance of the text-book, and in seeing that it is comprehended—translated into terms of reality—and relatively less to the elaboration of plans which involve the omission or slight use of text-books?

A STUDY OF VOLCANIC TOPOGRAPHY[1]

By ETHEL M. SMITH

THOUGH at the present time there are no volcanoes in the United States which can be said to be active, investigation has proved that at one time our western states constituted a region of abundant vulcanism. As would be expected, the volcanoes are distributed mostly along mountain ranges, the most prominent peaks being in the northern part of the Coast Range and the Cascades. Those of the Rocky Mountains seem, in general, to have suffered more erosion. A general survey of the region reveals volcanoes ranging from cinder cones, showing almost no dissection, to mountains long past maturity, whose craters have been destroyed and all but the roots removed.

It is the purpose of this paper, by describing conditions on a series of volcanoes, to show the part erosion has to play in the life of a volcanic peak, as it passes from early youth to old age and decay. Volcanoes which seem to be typical of certain stages of development have been selected and will be described in order, beginning with the cones which show least signs of dissection and closing the series with examples which are almost entirely removed.

CINDER CONE.[1] In northern California, between the Sacramento valley and the area known as the Great Basin, lies the Lassen Peak district, a broad belt of volcanic cones. The latest eruption in this region resulted in the youthful Cinder Cone. From the base of this cone, a rugged and fresh-looking lava coulée has escaped and spread out over the plains. Near the cone, the surface, where not covered with lava, is concealed with soft, black, volcanic sand, which, a quarter of a mile away, is seven feet deep. The summit of the cone has a well-developed crater with a double rim. The lava fields terminate in abrupt scarps, showing that the lava was of a viscous character. A thin, lacustrine deposit overlies part of the coulée, but no sign of erosion appears. The cone and lava are in perfect preservation and represent the youngest of volcanic forms.

Also of comparatively recent date, are the ICE SPRING CRATERS[1] in Utah. They are on a plain composed of the sediments of Lake Bonneville. At this place, there are three small craters of scoria and lapilli, which are fresh in appearance. Four miles south is a cone more recent than the withdrawal of Lake Bonneville because standing on lake sediments, but

[1] The studies which led to the present paper were carried on at Ohio State University, as a part of the work in Advanced Physiography, under the direction of Dr. George D. Hubbard, whose kind assistance has been greatly appreciated by the writer.

showing no wave erosion. It is named Tabernacle Crater because of its fanciful resemblance to the temple in Salt Lake City. The lavas about Tabernacle Crater are fresh in appearance and nowhere have yielded to the action of the atmosphere so as to form a soil. But this is not necessarily an argument in favor of very great youth in years, as the climate of Utah is so dry that weathering and erosion are very slow.

Dutton[2] refers to lava streams south of Panquitch Lake that are so fresh that they might have been poured out less than a century ago. Other streams near could hardly exceed a few centuries, as the cones are perfect, the lava not faded, and even the spongy, inflated scum of the surface is still black—only faintly tinged by atmospheric effects. Whatever their age in years, they are very young physiographically.

In Northern Arizona,[1] near the San Francisco Mountains, are numbers of recent lava cones. They are of black basalt and are grouped around larger cones. Many of these craters are as perfect as when formed and the streams of lava which escaped from them are as fresh as though just cooled.

Mono Valley Craters.[1] Russell describes an interesting group of volcanoes in Mono Valley, California. In some instances they show more maturity than the cones in the preceding group. In Mono Lake are two islands which sustain some of the most interesting craters. On the eastern shore of Paoha is a cone, formed from a broken, submerged crater wall. Toward the northeast is a hill which undoubtedly is the remnant of a volcano. The vent probably opened through a deposit of gravel, as not only the hill itself but the plains around are covered with rounded pebbles. These are mingled with blocks of basalt and become more numerous toward the hill already mentioned. The pebbles are not covered by lake sediment, but rest upon it, so they must have been brought since the island emerged from the water. Some of the craters on the island are of recent date. They show no wave marks and are of such construction that they would not have been able to stand against the action of water. They have therefore been formed since the island established its present level. Mono lake is wearing its way into some of the craters and one has been filled with water by percolation from the lake.

The other island is composed of a crater and a coulée of lava which, though of recent origin, is older than the Paoho coulée, because it has a thin coating of calcareous tufa.

About 10 miles south of Mono Lake is the crescent-shaped row of Mono Craters.[1] They are a portion of a much more extended series of

recent eruptions, following the general course of the great belt of branching faults which determine the eastern face of the Sierra Nevada. A coulée, at the southern end of the range, invaded a region occupied by a glacier and obliterated the upper portion of a deep stream channel made by the water that flowed from the melting ice. Thus Mono Craters were in a state of eruption after the existence of the Sierra Nevada glaciers. This statement is further strengthened by the deposits of fine, nearly white rhyolitic dust, which cover several moraines. These volcanoes show a slightly older age than such cones as the Ice Spring Craters. Slight signs of erosion, deposits, and partially removed craters, show an advance beyond extreme youth.

MT. BAKER.[1] The most northern volcanic pile in the United States is connected with the Cascades. Its form is an evidence that it is a volcano. From north to east the summit appears to be truncated. Possibly this is due to an explosion. Gibbs claims to have been told by the Hudson Bay Company and the Indians that this mountain was in activity in 1843, and that it broke out simultaneously with Mt. St. Helens.

MT. ST. HELENS.[1] This mountain also has a truncated top. Emmons was told by a Canadian traveler of an eruption, which made such an intense light twenty miles away that he could see to pick up a pin. With the aid of a field glass, lava tracks may be seen through the forests. The lava in some places has cooled around tree trunks so as to make perfect casts of their scarred and seamed trunks. "Blow holes," caused by lava flowing over wet places and forming bubbles are conspicuous. Fumaroles are still present. These volcanoes, Mt. St. Helens and Mt. Baker, seem to be almost identical in age. Both still preserve, in the main, the typical volcanic form and both have had minor eruptions scarcely a century ago. Yet both have lost portions of their cones and are heavily forested.

MT. SHASTA.[3] As a physiographic feature, Mt. Shasta has passed from the stage of vigorous growth into that of decline and is just beginning to show clearly the ravages of time. Waste is no longer balanced by repair. Erosion has the mastery. As far as shape is concerned, it is a typical example of a large volcano, made up of cinders and lava coulées. The volcanic origin of Mt. Shasta is indicated not only by its form and composition, but also by its structure. It is made up of irregular layers of lava alternating here and there with others of fragmental volcanic material. The layers overlap one another like the shingles of a conical roof.

From the east, Mt. Shasta appears to be a single cone, as if all its lava had escaped from one vent. Seen from the north, its double structure ap-

pears. There were two important vents. The principal summit is on the left. That on the right is lower. The rim of the summit crater is well preserved except on the west, where a part has been carried away. On the western slope, toward the base, are a number of smaller cones. Some are of cinders, others of lava, but the most common form of addition in building up Mt. Shasta was by coulées without cones.

A comparatively recent coulée appears on the southwestern slope of the mountain. It is timbered like the adjoining slopes. At an elevation of 1,000 feet from the base are some newer coulées. In general, they are smaller than the older ones beneath them. The largest coulée spread from a cone on the crest of the ridge, sending one arm toward Panther Creek and another toward Sacramento. All of the coulées mentioned are post glacial. These form only a thin veneer on its slopes. Most of the erupted lava is older and shows traces of glaciation. The upper slopes are deeply eroded by ice, the middle slopes are scarred by broad stream valleys, and the lower slopes are heavily aggraded with waste. Mt. Shasta was nearly as large during the glacial period as it is now.

The last vestiges of the heat of the mountain are found in the sulphurous, noxious gases, which constantly escape through a small group of openings on the summit, called the Hot Springs.

Mt. Hood.[4] Only a portion of the original summit crater remains on Mt. Hood, though according to Russell,[1] fumaroles are still steaming on its northeast slope and on the south side near Crater rock. The sulphurous fumes from these openings are still strong enough to discolor silver at a distance of a mile. The actual summit of the mountain consists of a block of lava only a few feet square. A. H. Sylvester[4] gives some recent observations on the mountain. He does not report the fumaroles mentioned by Russell. He does, however, describe a slight eruption of this volcano in 1907.

Although Mt. Hood has so recently been in eruption, it is maturely dissected. The rocks of which it is made up are greatly seamed and fissured and its internal structure much exposed. Water penetrates it easily therefore, and freezing shatters great masses. On the lower slopes, one sees all stages of such disintegration. Boulders as large as a house have been shivered into a thousand pieces by frost.

In the work of tearing down the mountain, ice has played the most important part, by gouging out canyons and cutting back into the mountain itself. The wide V-shaped valleys of the sandy and zig-zag rivers are partly glacier-sculptured. Forests have covered up and rains washed away

much of the evidence, but in the valley floors one sees large angular boulders which appear to be of drift origin. Moraines and striæ are also in evidence.

One of the most prominent features of the mountain is the fan-like outwash on the southwest side. The whole of this side of the mountain is deeply covered with glacial débris. Probably the forces that built up the mountain left it with a well-developed crater with the lip at the southwest side somewhat lower and probably of less resistant rock. When the ice age came on, glaciers formed on the side and gradually worked back until the whole southern rim was cut away and the materials that made it were spread out on the slopes below.

Mt. Taylor Region.[5] One of the characteristic table-lands, or mesas, of New Mexico, is covered with lava flows and sustains a prominent volcanic pile named Mt. Taylor. This mountain is almost entirely composed of lava, which rose through a single opening and built up a prominent cone with a large crater in the summit. The primitive form is now much altered by erosion. Its sides are deeply incised and its conical peak torn into sharp crags and spires. The volcanic cone occupies but a small portion of the area of the high plateau on which it stands. It is merely the focus and culminating point of a rather large field of volcanic action. The greater part of the lava which caps the great mesa came from numberless vents scattered over its surface. Some of these vents are still discernible and always in a dilapidated condition. The mesa suddenly descends by a succession of ledges and talus slopes into the country below, which is a medley of low cliffs. Out of these rise numbers of peculiar-looking, black objects—the necks of old volcanoes.[6] It is evident that the Cretaceous strata once covered this valley, and that the lavas, of which these necks are composed, found their way to the surface, where they outflowed. When the eruptions ceased, the lava remained solidified in the chimneys or vents. Then came a long period of erosion, in the course of which the Cretaceous strata, and all the lava sheets and cones which may have rested upon them, were swept away. The lavas congealed in the pipes offered a much more obdurate resistance to the denuding agencies and remained protruding upwards. Proof of their origin may easily be found by an examination of the slopes of the mesa. The necks are even more numerous close to the wall and are frequently seen in the wall itself. Sometimes, in the wall of the mesa, a good section of the old volcano is given, disclosing not only the neck itself, but the strata which included it, the lavas which flowed away from its orifice and the cinder cone which was built on top of it.

MARYSVILLE BUTTES.[7] A circular group of hills, with jagged and fantastic outlines, is all that remains of a mountain which once stood near the Sacramento River in California. These hills are spoken of as the Marysville Buttes. They probably once formed a volcanic mountain, the internal structure of which is to a remarkable extent now laid bare by erosion. In any view from a distance, two distinct features of the mountain are always noted,—first, the peripheral slopes reaching up to 600 feet or more in a long, gentle curve; second, the abrupt and jagged interior peaks and domes of which the North Butte and the South Butte are the most prominent. It is possible that when the great volcano was in active eruption, it formed one great cone, and that its original form can be reconstructed with considerable accuracy by carrying up the curves of the lower slopes.

BLACKFOOT[1] in Idaho is another example of a volcano that has almost passed away. Only the roots remain. These volcanoes are especially interesting as anatomical studies, and are quite characteristic of the Rocky Mountains, in which there are very few volcanoes recent enough to retain their characteristic volcanic topography.

Of the volcanoes described, those which seem to be of latest date and show no traces of erosion have preserved their conical forms and symmetry of slope. They must be listed as youngest, physiographically, at least. There can be no doubt that the cinder cones are youngest, even in years, for the material of which they are composed is least resistant to erosion.

Mt. Baker and Mt. St. Helens are scarcely beyond youth. They still preserve the typical volcanic form, though both have lost parts of their craters. Mt. Shasta and Mt. Rainier carry on the history of a volcano, whose once hot slopes, invaded by glaciers and attacked by all the forces of erosion, have lost their regular outlines and have become rugged and irregular.

The Mt. Taylor necks and Blackfoot complete the cycle, and represent a volcano in the last stages of degradation, when erosion has almost completed its work, and only a skilled geologist can recognize it for what it is, and imagine it in its former grandeur.

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THE WOOL INDUSTRIES OF CLEVELAND, OHIO

By ESTHER MATCHETT
Technical High School, Cleveland, Ohio

OHIO has been prominent in wool production since the beginning of the industry in this country. The first sheep were imported into America in 1609, at Jamestown, Va., but they were the coarser breeds, with short hair, and suitable only for mutton. Just preceding the War of 1812, farmers had a craze for the Merino and during war times "full-blooded Merino" wool reached the record price of $2.50 a pound, and the sheep sold for $3,000 a pair, but in the collapse in prices which followed, pure Merino sheep could be bought for $1.00 per head.

Stephen Atwood, an Ohio farmer, bought from one of the original full-blooded flocks in 1813, and bred carefully for over half a century. It was from one of the rams of his flock that the so-called "American Merino" was finally developed. Since that time, Ohio has been foremost in the raising of sheep, and at the present time, exceeds all other states east of the Mississippi in the annual production of wool.

The wool manufacturing industries have developed at Cleveland because of its favorable geographic situation. Being located on five trunk lines, its transportation facilities are of the best, and it has the added advantage of the low freight rates of the lake and canals. Coal is easily obtained from the Pennsylvania coal fields, and cheap labor is abundant on account of the large number of foreign immigrants who have been attracted to the Lake region.

At the present time, Cleveland probably produces one half of the state's entire output of woolen manufactured materials. There are six factories of woolens and worsteds in the city, the aggregate output of which is valued at considerably more than $2,000,000 annually. Between two thousand and three thousand men and women find employment with these establishments. The largest worsted mills in the city are those of the Cleveland Worsted Mills Company, second only in size to those of the American Woolen Company, located in Lawrence, Mass. The Cleveland Worsted Mills Company's establishment at Cleveland operates 35 carding machines, 30,000 spindles and 600 looms, consuming 30,000 pounds of wool, and turning out 15,000 yards of finished material daily.

Ohio produced 12,789,451 pounds of wool in 1906, which was only a small portion of the wool used in the factories, so that much wool

was imported, some from other states, but the larger part from England, Australia, Argentina and New Zealand. The wool of Ohio, however, ranks in quality among the best.

The value of wool as a weavable fiber, depends upon its texture and the length of the hair or "staple"—those of long "staple," called combing wools, being used for spinning into worsteds, and those of shorter "staple," carding wools, for felts and the woolens proper, such as soft flannels, blankets and soft finished cloths. Each fiber of wool is similar to a hollow tube entirely covered by small serrated scales overlapping one another. It is upon the interlocking of these scales that the value of the wool for spinning into a thread depends.

The stock-room of a large worsted mill presents an interesting appearance with its varieties of bales of wool from many foreign countries. There are large, loose bales of English wool, containing about 500 pounds each, and then, there are the hard, compressed, steel-bound ones from Buenos Ayres, containing 1,000 pounds each, and many others of various designs.

After being unpacked, the wool is sorted according to quality and stacked into piles which are labeled according to the various grades. Although the duty on English wool is 12 cents a pound and that on South American wool 11 cents, the cost of the domestic product to the manufacturer is about the same as that of the imported wool, due to the extra labor that is necessary to prepare it for the looms. In the first place, the American producer insists upon tying up his fleeces with twine which must be carefully picked out, as even the slightest piece would produce a flaw in the finished cloth.

Secondly, the foreign wools are well sorted before shipping, while it costs 2 cents a pound to perform this operation on the domestic product. And the English farmer, being forced by lack of space to practise intensive farming, takes the best care of his flock during its development and finally washes the wool thoroughly upon the sheep's back before the shearing, so that it loses but 20 per cent in weight by shrinkage, while the American wool loses from 46 per cent to 60 per cent.

The shrinkage of the wool is due to the fact that the fleece is full of the natural oil, a "yolk" or the "suint" as it is called, and this must be thoroughly scoured out before it can go to the carders. This scouring is done in large tanks filled with a solution of soda ash and hot water. It is kept moving in these tanks by wooden rakes or harrows, which work automatically and keep forcing the wool forward until it reaches the rollers

of a wringer, which squeeze out some of the dirt and drop the wool a little cleaner, into another tank similar to the first. This process is continued through four such tanks and then the wool is dried and sent to the carding room above. If the material is to be "dyed in the wool," it is sent directly from the driers to the dye-room, where it is dyed in large vats.

In the carding-room, the wool is straightened and drawn out so that the various hairs lie parallel to one another. The carding machine consists of a series of large and small cylinders, covered by wire carding cloth with iron or steel bristles, slightly bent, threaded through a foundation of either cotton and india-rubber, or leather. The cylinders turn in such a way that one pulls the wool from another cylinder and delivers it to a third, which in turn passes it on to the first again, and so on until the wool is pulled and straightened by "workers" and "strippers" and "fancys" and finally stripped off at the end of the machine by a "doffer" in a gauze-like film which is wound on a spool in a rope about two inches in diameter.

From the carders, the wool is taken to the combing room, where it is first run through a machine known as a "Gill box." This consists of two pairs of rollers, one pair of which rotates five or seven times as fast as the other pair, thus drawing the rope out to five or seven times its original length. The wool is now ready for the Noble combs, which consists of a set of circular combs, rotating about a vertical axis. These combing machines separate the short fibers from the long,—the former being discarded in a worsted mill, but are utilized for the manufacture of woolens and shoddy. After passing through the combs, the wool is again run through another set of "Gill boxes," where it is oiled with the best olive oil, to prevent it from becoming harsh and brittle, and drawn out still more and finally wound in tight, hard balls called "top."

The "top" is taken to the "drawing-room" where it is reduced in diameter and increased in length until it is finally wound upon spindles by "flyers," which make about 1,400 revolutions a minute. The much reduced woolen rope is now spun on spindles into fine thread ready for the weavers. Each spinning frame contains 200 spindles, each of which revolves at the rate of 7,200 revolutions per minute and winds the thread upon the smaller bobbins ready for the looms. For some goods, it is necessary to double the yarns, or to mix colors together or two fibers,—one of wool and one of silk,—and this is all done in the spinning-room.

One of the most interesting operations in the worsted factory takes place in the weaving-room. The pattern of the cloth has been made and

tested by the designers, who have analyzed the elements necessary to produce the result. From here, the orders for the pattern to be made go to the sorting room, the dye-house, the spinning and the weaving departments. In the weaving-room, the warp threads are reeled on a large drum, called the warping machine, then wound upon the loom beam. Each thread is drawn through its place in the loom harness, so that it may be lifted at the right moment for the pattern, and the beam and harness being placed in position on the loom, the ends of the warp threads are attached to the roller in front. The bobbin containing the weft or woof thread is placed in the shuttle-box and the machine is ready for weaving. As the harness lifts now one set of warp threads and then another, the shuttle darts back and forth, leaving behind it the woof threads or "picks," which are driven tightly in place by the batten. One girl of ordinary ability can easily tend two looms, as her duty is only to watch for broken threads, which she must tie together before they are woven into the cloth and produce flaws. Should she fail to do this the thread must be darned in the mending-room, where the cloth is sent after being cut from the looms.

In Cleveland all of the above operations are completed, but if the cloth requires further finishing, such as "fulling," "cropping," "dyeing in the piece,"—and most of the worsteds are dyed at this point,—or steaming, it is sent to the branch establishment in Ravenna, Ohio, where the water contains fewer minerals than that of Cleveland. The material is then sent back to Cleveland, whence it is shipped to all large manufacturing establishments and wholesale houses using cloth, in America. Some of it is sold as "imported material" on account of its quality.

Cleveland claims the largest shoddy factory in the world. Worsteds differ from woolens in that the former are made of the long "stapled" wool which admits of much drawing and twisting, while the latter is usually made of the short hair discarded from the worsted mills and the shoddy, which is manufactured from woolen rags collected by rag peddlers.

In the shoddy factory, the stock-room is an immense affair, filled with bales of assorted rags, which are carefully gone over in the sorting room and then passed through a huge compartment where they are treated with hydrochloric acid fumes. These destroy any cotton fiber, but do not affect the wool. The dust produced by the disintegrated cotton fiber is fanned out and sold to concerns making pipe coverings and asbestos goods.

The woolen fibers are then washed in large machines 8,000 pounds at a time. The drying process is begun in centrifugal machines and com-

pleted in ovens similar to those in the worsted mills. The dry, clean rags are now sorted as to color, untangled by hand, treated with an emulsion of hot oil and water, run through a picking machine, where the buttons and other foreign matter are eliminated and finally shredded, scoured, dried, dyed and carded, much as the pure wool was treated in the worsted mills.

In the shoddy factory, however, the process ends at this point as the short fibers will not admit of any further "drawing" and pulling. The product of the carding machines is therefore laid down in sheets—if to be used for tailors' wadding, wound on large cylinders, or merely packed loosely in boxes and shipped directly to some spinning house. Most of it, however, is baled in bales weighing from 200 to 700 pounds and sent to various establishments to be manufactured into hair-rolls, blankets, horse-blankets, or cloth. The shoddy sometimes sells as high as 30 cents a pound, and as but little skilled labor is necessary in its manufacture, most of the work being done by machinery, the profit is usually great.

Cleveland does not only hold a very important place in the manufacture of woolen and worsted cloth, but with her yarn and knit goods factories, blanket factory and ready-to-wear clothing establishments, for which she is noted throughout the United States, her reputation as a center for all-wool manufactures is rapidly growing, and no doubt with the proposed plans for the improvement of her inner and outer harbors carried to culmination, and the necessary increase in population and financial growth, she will make rapid strides toward first place in the union in the production of wool manufactured materials.

NEWS ITEMS

The winter meeting of the Association of American Geographers will be held at Cambridge, Mass., December 30 and 31, and January 1, under the presidency of Professor William Morris Davis of Harvard University. Hotel headquarters will be at the Copley Square Hotel, Boston.

At the Thanksgiving meeting of the Central Association of Science and Mathematics Teachers, one afternoon will be devoted to a round table discussion of Geography in Secondary Schools.

RECENT PUBLICATIONS

A CENTURY OF POPULATION AND GROWTH IN THE UNITED STATES, 1790-1900. Special Report of Bureau of the Census, Government Printing Office, 1909.

A series of descriptive chapters and statistical tables comparing the United States of 1790 with that of 1900. Contains many valuable historical maps and much reference material of great interest to the geographer and historian. A source for many problems in "human geography" that will help vitalize the geography of the United States in normal classes.

TIMES OF SUNRISE AND SUNSET IN THE UNITED STATES. Robert Wheeler Wilson; Cambridge, Harvard Coöperative Society, 1908.

A series of maps showing times of sunrise and sunset in the United States at eight-day intervals from January first to December thirty-first. Of great value in teaching this topic in high and normal schools. A book that should be in every geographical library for teachers.

LITTLE PEOPLE EVERYWHERE: A Series of Illustrated Geographical Readers. By Etta Blaisdell McDonald and Julia Dalrymple; published by Little, Brown & Company, Boston, 1909.

Attractive in form and printing. The few illustrations in each volume well done. Each volume contains a pronouncing vocabulary and index.

Rafael in Italy: pp. vi+119. Word pictures of Italy from Venice to Naples written in a mature manner and suitable for the upper grades only.

Kathleen in Ireland: pp. vi+118. Descriptions of selected places in Ireland written in an interesting way that will appeal to children. A good presentation of a picturesque country that has been hitherto neglected.

Manuel in Mexico: pp. vi+118. A book for the upper grades dealing with things of interest to children.

Umé San in Japan: pp. 118. A book for children written in a more personal vein than either of the preceding volumes.

HANDBOOK FOR FIELD GEOLOGISTS. By C. W. Hayes; pp. ix+159. New York, John Wiley & Sons, 1909.

A handbook for geologists, of great value to teachers and workers dealing with the physiography of the lands. Includes general instructions as to field equipments, observations and records and special instructions as to the observation of land forms, rocks, glacial deposits and economic resources.

NOTES

LOCATING THE NORTH POLE.—"What are the various astronomical observations taken and what instruments are used for determining the observer's position when near the North Pole and when actually at the North Pole?"

Answer.—In theory there is no greater difficulty in determining one's position in the Arctic than at any other position of the globe. The observations of the sun or stars are such as would be taken elsewhere and may be worked by the same methods.

The instruments employed are the same as those used by mariners in all seas, but special care should be taken in their construction to insure extreme lightness and to guard against possible errors due to unequal expansion and contraction of the various metals in the great changes of temperatures to which they are to be exposed. In the expedition of the Duke of the Abruzzi some of the sextants were made of aluminum.

All the astronomical observations of this expedition were made by sextant, the ordinary type being used on the ship and the aluminum instruments on the journeys over the ice.

Particular care must be taken in the selection of the chronometers. These instruments are subject to errors under the most favorable conditions of handling and temperature. It is inevitable during the hard knocks of a sledge journey in a temperature low enough to congeal the oil with which they are lubricated that chronometers can not be considered the instruments of precision they are under better conditions.

As their use is principally in determining the longitude, errors in this direction are of little moment near the pole. At the pole, where all meridians converge, one longitude is the same as another, and every altitude is a "Meridian Altitude," which does not require a chronometer for its solution.

The greatest difficulty in astronomical work in the Arctic lies in getting a suitable horizon. The mariner in the open sea in clear weather has little difficulty in measuring the angle between any heavenly body and the actual visible sea horizon. On shore or surrounded by a sea of ice in various forms there is no such thing as a level unbroken sea horizon, so that it becomes necessary to resort to an artificial horizon of some sort. The usual method is to use a basin of mercury which, when sheltered from the wind by a glass cover, forms a perfectly smooth horizontal surface in which the heavenly bodies are brilliantly reflected. It is then only necessary to

measure with a sextant the angle between the body in the heavens and its reflection in the artificial horizon to determine its actual elevation above the true horizon. It must be remembered, however, that mercury freezes at about 40° F. below zero, and has accordingly a very limited field of usefulness in the Arctic. For this reason and on account of its weight some other form of artificial horizon is necessary.

Other liquids besides mercury have been used, as have also glass mirrors made horizontal by means of screw legs and spirit levels. These last require great care in adjusting, and there is always more or less error attending their use. With the above instruments one can determine his position with sufficient accuracy whenever the sun, moon, or any of the principal stars are visible, but, having done so, it is a matter of no small difficulty to ascertain what is the proper direction in which to travel to be sure of always going north.

The compass to which we are accustomed to look for guidance does not, as is well known, point to the geographical pole, but to a region some distance south of it called the magnetic pole. This has been located to the northwestward of Hudson Bay, and at any place between that and the true pole the compass needle will point south instead of north. If to one side of the magnetic pole it will point more or less east or west, as the case may be.

In preparing for a sledge journey in the Arctic it has been found advisable to have a special chest for instruments, usually secured to the front of the sledge. This should contain a sextant, an artificial horizon of a nonfreezing type, one or two chronometers, and the tables of logarithms and the astronomical data of the sun, moon, and stars, necessary in working out observations.

It is advisable that a pocket chronometer be carried on the person in order that it may get the warmth of the body and be spared the jolting of the sledge.

Other instruments may be carried for the collection of scientific information, but the above are all that is necessary for locating one's position. They should be made as light as possible and secured in a water-tight box, so that although the sledge may be completely upset or immersed in water, no damage can come to the instruments.

A chart of some sort is desirable, but as it covers a field entirely unsurveyed it may be composed of a blank sheet of paper with a dot in the center representing the pole.

The drawbacks to determining one's position in the Arctic do not lie in the computations, but in the great difficulty of securing accurate observations.

The lenses and mirrors of the instruments are covered with frost from the warmth of the body or the breath, the lubricating oil freezes in the joints, the silver backing of the mirrors crack and granulate in the cold, and the artificial horizons freeze if liquid, and refuse to stay horizontal if solid.

Should there be fog or the heavens be overcast no observations are possible.

During the six months of summer daylight the stars are not visible, although the brightest planets might be seen under especially favorable circumstances. The Pole Star, even if visible in winter, is of no practical utility.

After the observation is taken certain corrections must be applied to the observed altitude to convert it to the true altitude. Of these the correction for refraction is the most subject to variation.

The irregular appearance of the disk of the sun near the horizon when rising or setting is well known. In the Arctic the sun is always close to the horizon, and its rays in traversing the atmosphere are strongly refracted. This, if not allowed for, is sufficient to cause an error of from 2 to 36 miles, but as its amount is known and tabulated for ordinary conditions such errors are not very likely to occur.

As the pole is approached the observations become very simple. At the pole the altitude of any heavenly body—the sun for instance—is the same as its declination or distance north of the equator as given in the astronomical tables. An explorer then, approaching the pole, need only take an observation of the sun at noon, and after correcting the observed altitudes for errors of instruments, refraction, etc., compare this correct altitude with the declination given in the tables. The difference between the declination and the altitude is the distance he is from the pole. As he draws nearer to the pole it becomes of continually lessening importance that his observation be taken exactly at noon, and when at the pole it may be taken at any time and will be the same as the given declination at that time.

It thus becomes a very simple matter to determine one's position at the pole. As one's distance from the pole increases the computation requires slightly more time, but still remains very simple. The following method

can be employed at any time, but various other methods are equally available.

The time of the observation is taken by the pocket chronometer, and by a comparison with the other chronometers the exact time of Greenwich is determined. To this is applied the longitude (approximate), and the difference between watch time and sun time (equation of time), which gives the time as shown by the sun; that is, its angle from the meridian at the observation. With this "hour angle" (t), and the declination and approximate latitude, the sun's altitude is computed by the following formula:

$$\sin h = \text{Cos}\ (\text{L} - d\ ) - 2\ \sin^2 \tfrac{1}{2}\ t\ \text{Cos L Cos}\ d$$

The altitude of the sun (h), thus obtained, is then compared with the observed altitude after correction, and the difference is the distance in miles the observer is from the assumed position given by the latitude and longitude used in the computation.

His direction from the assumed position is toward or away from the sun, according to whether his observed altitude was greater or less than the altitude obtained by computation. By marking on the chart the assumed position in the latitude and longitude used, and drawing a line through this point in the direction of the sun's bearing (the direction which would be indicated by the shadow of an upright staff), the correct position can be found by measuring off on this line, away from the assumed position, a distance equal to the difference between the observed and the calculated altitudes. [Reprinted from the Pilot Chart of the North Atlantic Ocean for October, 1909, published by the U. S. Hydrographic Office, under the authority of the Secretary of the Navy.]

Navigation on the Upper Rhine.—A note on the issue of the *Revue Générale des Sciences* for May 15 gives some account of the progress which has been made in the improvement of navigation on the upper Rhine, and notably between Strasburg and Bâle. In 1908 the period when the river was navigable in this section lasted 191 days, of which 144 only were utilized. The total number of journeys between the two places was thirty, and the total tonnage carried 13,877 tons, or more than three times the weight carried in 1907. The goods carried were first coal, then cereals and iron ores. The return traffic is insignificant, consisting chiefly of the products of the electro-chemical industry of Switzerland, and notably of carbide of calcium. Both upstream and downstream from Bâle passenger traffic is greatly increasing; in 1908, 50,000 passengers

were carried, as against 3,000 in 1907. The journey from Strasburg to Bâle takes thirty hours against the stream and five only in the contrary direction. The difference in cost as compared with railway transport does not appear to be very great. Ten tons of coal are transported by rail from Strasburg to Bâle for 40 fr., while the freight by river between the two places is 31 fr. 25. The efforts which have been made to improve the navigation are due to a private company, assisted by both the Federal and Communal authorities, and the figures given above show that so far progress has been rapid.

—From *The Scottish Geographical Magazine,* October, 1909.

A New Compass Card.—The old style of numbering the degrees on a compass card from 0° north and south to 90° east and west has been supplanted in the United States Navy by a new plan whereby the degrees are marked from 0° at the north increasing to the right to 359°, thereby saving possible confusions in recording directions of a ship's course.

The Travels of Sand.—The travels of sand have long been a matter of scientific record. Years ago it was established that particles picked up on the coasts of Pas de Calais had their origin in the rocks of Brittany, from 120 to 180 miles distant. Another standard fact is the discovery on the coast of Denmark of chalk dust which undoubtedly came from the cliffs of Normandy.

Professor Thoulet, the French oceanographer, has determined the precise manner in which these particles travel such great distances. He finds that the result is due entirely to the action of waves and tides, causing the particles of sand to pursue a zigzag course, which he likens to the teeth of a saw, and having in the Channel and the North Sea a general direction from east to west.

M. Thoulet calculates that each grain travels at least 8,000 yards up and down the beach under the impulse of the incoming and retreating waves for each yard that it is conveyed parallel with the coast line. On an average about fifteen waves a minute strike the beach, and these cause a lateral movement of about one centimetre, or one tenth of an inch, which, however, is apt to be constantly reversed by winds, currents, and obstructions. Thus, allowing something for the influence of the wind when the sand is dry, the sand from Brittany found along the Pas de Calais strand must have traveled something like a million miles to reach there.

—From *Harper's Weekly,* November 13, 1909.